Generating Global CH₄ NASA GEOS Product by Assimilating TROPOMI
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Motivation
• Methane (CH₄), a potent greenhouse gas, after a period of minimal growth (1999-2006) has shown a renewed steady growth from about 2006 (Figure 1).
• The cause for this steady growth is not fully understood, but an evidence of decreasing δ¹³CH₄ points to microbial sources (agriculture-waste emission sector and wetlands) as a potential culprit.
• Further global investigation is required to better understand the mentioned CH₄ increases.

Objectives
• To create a reliable, easy to use, global atmospheric CH₄ product that could contribute to assessment of emissions processes.
• Potential applications of this approach include support for interpretation of high-resolution point source detection approaches, climate and greenhouse gas reanalyses, and boundary conditions for regional modeling approaches.

Methods
• NASA Goddard Earth Observing System (GEOS) based global CH₄ simulation is constrained by atmospheric transport from the Modern-Era Retrospective analysis for Research and Applications, Version 2 (MERRA-2) and retrieved CH₄ from the TROPOspheric Monitoring Instrument (TROPOMI).
• This product uses the Constituent Data Assimilation System (CoDAS) capability of GEOS, which assimilates constituent observations, both point samples and column averages.

Preliminary Results
• We perform assimilation and compare it to CH₄ column-averages from TCCON.
• Initial comparisons show that TROPOMI significantly improves our initial CH₄ simulation.
• Further comparisons are needed as still our biases are significant.

Future work
• Next steps would include updated CH₄ emissions and improved oxidation rates.
• Then tagged tracers could be used to identify specific areas where emissions are likely incorrect.